California Regional Water Quality Control Board
Central Coast Region

Winston H. Hickox
Secretary for Environmental Protection

Gray Davis
Governor

Internet Address: http://www.swrcb.ca.gov/rwqcb3
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401
Phone (805) 549-3147 • FAX (805) 543-0397

September 30, 2003

Mr. Richard W. McClure
Olin Corporation
Environmental Remediation Group
PO Box 248
Charleston, TN 37310-0248

Mr. Jay McLaughlin
President and CEO
Standard Fusee Corporation
PO Box 1047
Easton, MD 21601

Dear Mr. McClure and Mr. McLaughlin:

SLIC: 425 TENNANT AVENUE, MORGAN HILL; COMMENTS ON OLIN'S DEVELOPMENT OF SCREENING LEVELS FOR PERCHLORATE IN SOIL AND INITIAL DESIGN FOR COMBINED FULL-SCALE REMEDIATION OF PERCHLORATE-IMPACTED SOIL & ON-SITE GROUNDWATER REPORTS

This letter is a revised version of a letter originally dated September 19, 2003. The changes include extending the due date for the soil cleanup feasibility study from October 31 to November 21 and adding language to the December 31 requirement to excuse delays due to circumstances beyond Olin and Standard Fusee's control. These changes were discussed in a phone call among Regional Board and Olin staff on September 26, 2003.

Regional Board staff has reviewed GeoSyntecs's August 2003 reports: *Development of Screening Levels for Perchlorate in Soil at the Olin-Standard Fusee Site* and *Initial Design for Combined Full-Scale Remediation of Perchlorate-Impacted Soil & On-Site Groundwater*. GeoSyntec submitted the reports on behalf of Olin Corporation. Our comments discussed below incorporate comments provided by Santa Clara Valley Water District and the cities of Morgan Hill and Gilroy. We recognize that many of these comments discuss issues that will be addressed in your 45% and 90% design reports scheduled for submittal in mid September and late October respectively. Olin and its consultants have already indicated in a recent teleconference that many of the details discussed below will indeed be provided. Our purpose in detailing these issues now is to convey our expectations for a viable remedial solution.

Development of Screening Levels for Perchlorate in Soil (Screening Level Report) - This document presents calculations of a perchlorate concentration that Olin contends could remain in soil at the site without further impacts to groundwater quality, human health, or the environment. GeoSyntec proposed a soil screening level (SSL) of 50 micrograms per kilogram (µg/kg) using previous soil sample results and methods described in *Soil Screening Guidance: User's Guide*, published by the U.S. EPA in 1996. Our comments on this report are listed below.

1. Given the shallow depth to groundwater (7' below ground surface in 1997) and the high solubility of perchlorate, it is reasonable to expect that almost no attenuation is provided by

soil. The calculated SSL therefore primarily reflects dilution of perchlorate in the receiving groundwater. In cleanups overseen by regional boards, the point of compliance is typically the water table rather than the property line or the lateral limits of perchlorate occurrence in site soils.

2. The San Francisco Regional Water Quality Control Board (Region 2) has established a screening level of 7 µg/kg for perchlorate in soil to protect water quality for drinking. This screening level is intended to provide a value that can be used to decide whether further investigation of soil contamination should be performed. The level to which soil should be remediated is generally evaluated and proposed after the extent and magnitude of the contamination is known. A logical starting point for the exercise GeoSyntec has completed would be to perform the SSL analysis using Region 2's ESL as a starting point, and then to derive a risk-based site-specific soil cleanup level using site-specific values. Some of the important parameters used in calculating the soil screening level value that were estimated include dry soil bulk density, permeability, porosity, saturated vadose zone hydraulic conductivity, aquifer hydraulic conductivity, and organic carbon content. There was insufficient site-specific data to support calculation of a site-specific screening level value.
3. The laboratory practical quantification limit (PQL) for most soil analyses performed at this site is 10 µg/kg. Judging by the contoured perchlorate soil concentrations presented in Figures 2-5 through 2-8 in the Screening Level Report, the Target Treatment Area would not be significantly larger if the 10 µg/kg PQL were used. To mitigate the uncertainty inherent in soil chemistry characterization, we believe using 10 µg/kg as a cleanup level would provide greater protection of groundwater from further perchlorate contamination. Given the low cost of the proposed remedial technology, adding a few more thousand square feet to the Target Treatment Area would significantly increase the likelihood for successful removal of perchlorate from soil, without a substantial increase to the cost of cleanup as proposed.
4. If Olin and its consultants nonetheless decide to complete the exercise of developing an SSL using the methods you have selected, you should do so in a manner that accounts for the inherent uncertainty and error involved in making multiple interdependent assumptions. Specifically, the analysis should include:
   a. Sensitivity Analysis: upon which variables is the determination most dependent?
   b. Uncertainty analysis: how accurate are the estimates and assumptions used to assign values to the variables in these equations?
   c. Error analysis: what is the cumulative effect of uncertainty and error in multiple interdependent variables on the estimated Soil Screening Level?
   d. Factors of Safety: the analysis should address uncertainty and error by applying a factor of safety, for example, using the lower range of the Draft Public Health Goal, 2 µg/L, as the target soil leachate concentration (the Cw term in the equation), instead of the provisional Department of Health Services Drinking Water Action Level of 4 µg/L.

Initial Design for Combined Full-Scale Remediation of Perchlorate-Impacted Soil & On-Site Groundwater - This document presents a preliminary plan to remediate soil and groundwater at the Olin site through extraction of groundwater from two wells, on-site treatment of the extracted groundwater using ion exchange resin, off-site disposal of some portion of the treated water, and re-application of some portion of the treated water to ground surface at the site to flush perchlorate from the vadose zone. Our comments follow:

1. Olin's proposal to install and operate an interim shallow groundwater extraction and treatment system is welcome. Implementation of this proposal should proceed without delay and independent of the acceptance of proposed soil remediation measures. We believe this measure will provide a degree of hydraulic control and begin removal of perchlorate already verified to be present in groundwater beneath the site at concentrations up to 2,600 µg/L. The precise design of a final groundwater remedy can await proposed aquifer testing that can proceed concurrent with interim groundwater remediation. The aggressive schedule proposed for installation of interim groundwater treatment is also viewed as a positive step.
2. The disposition of treated groundwater is critical to the success of interim groundwater treatment. The proposal suggests that extracted groundwater can be managed on the site by infiltration and possible reinjection. A more reliable scheme involving permitted off-site discharge would allow system operation even if conditions prevent on-site disposal of treated groundwater. Moreover, mounding of the water table may cause perchlorate migration in unintended directions, and reinjection may cause redistribution of perchlorate in groundwater, which if not recaptured, may worsen groundwater contamination. We believe a successful groundwater remediation plan depends on securing an off-site discharge or re-use option, particularly since the extraction rates necessary to maintain hydraulic control over site groundwater may be considerably higher than proposed.
3. The soil flushing and groundwater extraction and treatment was proposed without a remedial alternatives analysis evaluating the effectiveness, feasibility and cost of the various remedial options. We have the preliminary description of only one remedy, and therefore cannot determine whether the proposed remedy is the best solution for this site. Soil flushing at a site with identified clay layers in the vadose zone presents a very real risk of spreading contamination into previously non-impacted soil, and there is a risk that perchlorate flushed into groundwater may not be captured by the proposed groundwater extraction wells. The cost of performing an appropriate investigation of subsurface properties prior to initiation of soil flushing, combined with the cost of installing, operating, and maintaining a network of instruments sufficient to monitor and prevent lateral migration of perchlorate, may be more expensive than excavation of impacted soil with off-site disposal or on-site ex-situ treatment. At this point in a cleanup investigation and remedial design, ranking the technical and cost elements of the remedial alternatives suggested in the March 31 reports would be a logical step. It would also make sense to propose a phased approach, in which interim source control for site soils is ensured for the highest concentrations while the longer-term remedy for site-wide soil contamination is developed.
4. We believe that the task of interim soil remediation calls for a rapid and readily verifiable remedy. Excavation of the highest concentrations of perchlorate in soil, for example above 500 µg/kg, would remove those soils which most threaten to worsen groundwater contamination and should be seriously considered. Excavated soils could be securely stored on the site for future ex-situ bioremediation or hauled off-site to a nearby landfill. If the worst of the soil contamination is excised by targeted excavation in the areas of highest contamination, then consideration of an in-situ bioremediation or soil leaching approach is warranted for the larger area of low concentration soils.
5. The proposed approach, flushing perchlorate from soil to groundwater, capitalizes on the solubility of perchlorate and follows the pathway by which perchlorate was first released. In this sense, the leaching strategy is intrinsically sound; however, the success of this approach depends entirely on the demonstrated ability to capture perchlorate flushed to groundwater.

In the current preliminary draft, we are given only an allusion to future design of water table extraction wells to control perchlorate flushed to soil. While site aquifer data are not yet available to design shallow perchlorate capture, a more reassuring design would explicitly call for multiple extraction wells capable of establishing redundant capture zones overlapping in both the lateral and vertical directions.

6. The single proposed shallow extraction well screened from 30 feet to 65 feet bgs should not be expected to achieve capture of perchlorate impinging on the water table since groundwater has been measured as shallow as 7 ft below ground surface. The vertical separation of the proposed screened zone and the maximum water table, coupled with horizontal lenses of fine-grained soils, may impede the successful capture of perchlorate leached to the water table. An approach using staggered screen zones for closely-spaced extraction wells screened in vertical intervals spanning the expected range of the water table will go further toward ensuring all perchlorate flushed to groundwater is captured, minimizing the chance of off-site migration.
7. To ensure the effectiveness of a more aggressive extraction scheme, the proposal should also include additional monitoring wells installed along the southern edge of the site with screens in multiple vertical zones down to bedrock (about 400 feet below ground surface). Similarly, additional monitoring should be added to the east and west to address any lateral movement of added water.
8. The approach of flushing, extraction, treatment, and recirculation affords a number of advantages if conservatively deployed with enough attention to factors of safety to ensure failsafe operation. The water used to flush perchlorate from soil should be labeled with a unique tracer, such as bromide or isotopically exotic water. Use of tracers will allow calculation of the amount of water that was added to the soil profile recovered in extraction wells and migrating to property-line monitoring wells. This technique would support fine-tuning in case capture is insufficient in a particular area.
9. The proposed in-situ leaching strategy apparently assumes that saturated soil conditions will be achieved. We believe it is likely that saturated soil conditions will be encountered at certain horizons, but the presence of sands and gravels will probably lead to preferential pathways along lenses of clays and silts under an unsaturated flow regime. Accordingly, monitoring of this remedial effort should acknowledge the likelihood that unsaturated flow would be the dominant mechanism by which perchlorate would be leached from soil. In representative areas whose soil textures are known from soil sampling borings, neutron probe access tubes should be installed to permit delineation of the moisture profile and wetting front at a few points within the Target Treatment Area.
10. Additional unsaturated zone monitoring would improve assurance of effective remediation. Various approaches for tracking moisture, such as installation of gypsum blocks, tensiometers, and/or use of time-domain reflectrometry across the Target Treatment Area will improve ability to track the migration of percolated water. Confirmation of flushing effectiveness could be obtained by installation of suction lysimeters at different levels in the soil profile, and analyzing soil-moisture samples for perchlorate and the added tracer before, during, and after flushing.
11. An assumption inherent to the proposed approach is that flushing will reach and remove all perchlorate residues residing in shallow soils. Post-flushing sampling will be necessary to verify successful removal of perchlorate by flushing, but soil sampling is irreproducible and verification will be dependent on potentially ambiguous statistical analysis. The joint

uncertainties of the effectiveness of soil flushing and the accuracy of soils characterization lead us to favor excavation of the highest concentrations. In-situ bioremediation or soil flushing, if proposed in a manner that addresses the concerns raised here, may be acceptable for the larger areas of lower perchlorate concentrations where the risk of failure would be less consequential.

12. The pathways perchlorate may follow in response to the preferred application method, a driptape layout, cannot be assumed to be vertical without providing some site-specific justification for this assumption. Consideration should be given to the effect of laterally continuous clay beds on perchlorate movement. Where there is potential for matric suction or concentration gradients to deliver perchlorate well beyond the Target Treatment Area, these pathways could be interrupted with trenches backfilled with coarse-grained material.
13. The apparent offset of the bedrock elevation (shown on Figure 5 of the Initial Design Report, between the Tennant Avenue well and MW-SW-005) may be from a fault. If this is in fact the case the fault may further complicate preferred pathways and be a barrier to flow across the fault and a pathway for flow along the fault.
14. The apparent vertical downward gradient shown on the provided cross section (Figure 2-11 of the Screening Level Report) could result in spreading perchlorate contamination to an apparently clean zone below 110 feet below ground surface.

We understand that the Initial Design report was not intended to answer all concerns at this stage, and provides plans and schedules for obtaining data needed for completing the design. The Initial Design and Soil Screening Level Analysis nevertheless provide enough information to identify key concerns. The flushing approach, while aggressive and more likely to achieve its goals in a short time frame than in situ bioremediation, carries with it enough risk to warrant concern. Should bench testing now in progress confirm suitability of adding a carbon substrate to induce denitrifying conditions for microbial reduction of perchlorate, this option should be pursued. We strongly favor a hybrid flushing and in-situ bioremediation approach for low-level perchlorate soils remaining after excavation of higher concentration soils is completed. This approach should include sufficient capture and monitoring to ensure effectiveness and reduce uncertainty.

Pursuant to section 13267 of the California Water Code, Olin is hereby directed to submit the following technical reports:

1. By **November 21, 2003**, a study considering the effectiveness, feasibility, and relative costs of applicable cleanup alternatives in addition to the approach proposed in the Initial Design report, including the potential combinations of full or partial excavation coupled with on-site soil treatment or off-site soil disposal. The analysis of off-site disposal must include the option of disposal at a local landfill.
2. By **October 24, 2003**, a report documenting the installation and hydraulic testing of wells for an interim on-site groundwater extraction and treatment system. The system proposed in the Initial Design report is acceptable provided the shallower well screen is lengthened or a third well is added to capture groundwater first encountered below ground surface. These wells could also be used to assess hydrogeologic conditions at the site and assist with the design of the final remedial system.

3. By **December 31, 2003**, a report regarding startup of the interim on-site groundwater extraction and treatment system. Olin expects to have the system operational by December 31, 2003, barring unforeseen delays due to circumstances beyond Olin and Standard Fusee's control.

The Regional Board needs these reports to ensure timely, appropriate cleanup of soil and groundwater at the subject site. The evidence supporting this request includes data previously submitted by Olin demonstrating perchlorate contamination resulting from Olin's operations at the site. Failure to comply with requests pursuant to Water Code section 13267 may subject you to enforcement action, including imposition of civil liability in an amount up to $1000 per day of noncompliance.

Any person affected by this action of the Regional Board may petition the State Water Resources Control Board (State Board) to review the action in accordance with Section 13320 of the California Water Code and Title 23, California Code of Regulations, Section 2050. The petition must be received by the State Board within 30 days of the date of this order. Copies of the law and regulations applicable to filing petitions will be provided upon request.

If you have any questions, please contact **A. John Mijares at (805) 549-3696** or Harvey Packard at (805) 542-4639.

Sincerely,

Roger W. Briggs
Executive Officer

ajm/s/icb/cru/johnm/olin../rick mcclure comments on ssl and initial design reports 5sep03

cc: Olin Correspondence List

do not mail
Sylvia Hamilton

Mr. Jim Ashcraft
City of Morgan Hill
17555 Peak Avenue
Morgan Hill, CA 95037

Mr. Rich Chandler
Komex
2146 Parker Street, Suite B-2
San Luis Obispo, CA 93401

Mr. Peter Forest
San Martin County Water District
PO Box 1501
Morgan Hill, CA 95038

Mr. Steven L. Hoch
Hatch & Parent
11911 San Vicente Boulevard, Suite 350
Los Angeles, CA 90049

Mr. Eric Lacy
CA Dept. of Health Services
2151 Berkeley Way
Berkeley, CA 94704-1011

Ms. Helene Leichter
City of Morgan Hill
17555 Peak Avenue
Morgan Hill, CA 95037

Mr. Eugene Leung
CA Dept. of Health Services
2151 Berkeley Way
Berkeley, CA 94704-1011

Mr. Bobby Lu
MACTEC Engineering and Consulting
200 Citadel Drive
Los Angeles, CA 90040-1554

Mr. Tom Mohr
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

Ms. Suzanne Muzzio
Santa Clara Co. Env. Health Services
1555 Berger Drive, Suite 300
San Jose, CA 95112-2716

Mr. Bill O'Braitis
MACTEC Engineering and Consulting
200 Citadel Drive
Los Angeles, CA 90040-1554

Mr. Keith M. Casto
Sedgwick, Detert, Moran & Arnold
One Embarcadero, 16th Floor
San Francisco, CA 94111-3628

Ms. Jennifer Soloway
State Water Resources Control Board
Office of the Chief Counsel
P. O. Box 100
Sacramento, CA 95812-0100

Mr. Joe Root, General Manager
Corde Valle
One Corde Valle Club Drive
San Martin, CA 95046

Mr. Rob Stern
7510 Kenbrook Place
Suwanee, GA 30024

Ms. Carla Ruigh
Gilroy Community Services
7351 Rosanna Street
Gilroy, CA 95020

Ms. Kathy Kretchmer
Deputy County Counsel
Office of the County Counsel
70 W. Hedding St., 9th Floor, East Wing
San Jose, CA 95110